Amendment to claims

1. (Origingal) A method for refining a semiconductor wafer having a semiconductor wafer surface comprising the steps of:

providing at least two refining elements;

holding the semiconductor wafer for refining; and

applying at least two independent operative refining motions to the at least two refining elements and wherein the operative refining motions include at least one electrochemical action during at least a portion of a refining cycle time.

2. (Currently amended) The method for refining according to claim 1 wherein applying the at least two independent operative refining motions ~~comprises~~ comprise using at least one action selected from the group consisting of a chemical action, a tribochemical action, and a frictional action for removing a material from the semiconductor wafer surface.

3. (Origingal) The method for refining according to claim 1 wherein the at least one electrochemical action comprises the at least one electrochemical action for removing a material from the semiconductor wafer surface.

4. (Origingal) The method for refining according to claim 1 wherein the at least one electrochemical action comprises the at least one electrochemical action for adding a material to the semiconductor wafer surface.

5. (Origingal) The method for refining according to claim 1 having the additional steps of:

providing a control subsystem having an operative sensor, a processor, and a controller;

during the at least two independent operative refining motions, sensing with the operative sensor a progress of refining information;

during the at least two independent operative refining motions, determining a change for at least one process control parameter with the control subsystem using the progress of refining information; and

during the at least two independent operative refining motions, changing the at least one process control parameter.

6. (Origingal) The method for refining according to claim 5 wherein changing the at least one process control parameter makes an appreciable change to the refining.

7. (Currently amended) The method for refining according to claim 1 wherein:

the semiconductor wafer has a tracking code;

and before applying the operative refining motion, the method having the additional steps of:

providing an operative control subsystem having an operative sensor, a controller, and a processor; ~~processor and wherein the processor has access to a process model, the tracking code, and information in at least one memory device;~~

and during applying the operative refining motion, the method having the additional steps of:

sensing a progress of refining information with the operative sensor;

determining a change for at least one control parameter using at least in part at least ~~the~~ a process model, the ~~assigned~~ tracking code, ~~the~~ information in at least one memory device, and the progress of refining information with the operative control subsystem; and

changing in real time the at least one process control parameter which changes the refining.

8. (Origingal) A method for refining a semiconductor wafer having a semiconductor wafer surface comprising the steps of:

providing at least two refining elements;

holding the semiconductor wafer for refining; and

applying at least two different operative refining motions to the at least two refining elements and wherein the operative refining motions include at least one electrochemical action during at least a portion of a refining cycle time.

9. (Currently amended) The method for refining according to claim 8 wherein applying the at least two different operative refining motions ~~comprises~~ comprise using at least one action selected from the group consisting of a chemical action, a tribochemical action, and a frictional action for removing material from the semiconductor wafer surface.

10. (Currently amended) The method for refining according to claim 8 wherein the at least one electrochemical action comprises ~~the~~ an at least one electrochemical action for removing a material from the semiconductor wafer surface.

11. (Currently amended) The method for refining according to claim 8 wherein the at least one electrochemical action comprises ~~the~~ an at least one electrochemical action for adding a material to the semiconductor wafer surface.

12. (Origingal) The method for refining according to claim 8 having the additional steps of:

providing a control subsystem having an operative sensor, a processor, and a controller;

during the applying at least two different operative refining motions, sensing with the operative sensor a progress of refining information;

during the applying at least two different operative refining motions, determining a change for at least one process control parameter with the control subsystem using the progress of refining information; and

during the applying at least two different operative refining motions, changing the at least one process control parameter.

13. (Origingal) The method for refining according to claim 12 wherein changing the at least one process control parameter makes an appreciable change to the refining.

14. (Currently amended) The method for refining according to claim 13 after determining a change for the at least one process control parameter having the additional step of:

storing the progress of refining information and the change for the at least one process control parameter in a memory device.

15. (Currently amended) The method for refining according to claim 7 wherein:

the semiconductor wafer has an assigned tracking code;

and before applying at least two different operative refining motions, the method having the additional steps of:

providing an operative control subsystem having an operative sensor, a controller, and a processor; ~~processor and wherein the processor has access to a process model, the assigned tracking code, and historical performance;~~

and during applying at least two different operative refining motions, the method having the additional steps of:

sensing progress of a first progress of refining information with the operative sensor;

determining a first change for at least one control parameter using at least in part at least ~~the~~ a process model, the tracking code, ~~the~~ historical performance, and the first progress of refining information with the operative control subsystem; and

changing in real time the at least one process control parameter which changes the refining.

16. (Origingal) The method for refining according to claim 15 after determining the first change for the at least one process control parameter having the additional step of:

storing at least in part at least the process model, the tracking code, the historical performance, and the first progress of refining information in a memory device.

17. (Origingal) The method for refining according to claim 16 after storing at least in part the tracking code, the historical performance, and the first progress of refining information in a memory device having the additional steps of:

sensing a second progress of refining information with the operative sensor;

determining a second change for at least one control parameter using at least in part at least the process model, the tracking code, the historical performance, the first progress of refining information, and the second progress of refining information with the operative control subsystem; and

changing in real time the at least one process control parameter which changes the refining.

18. (Currently amended) The method for refining according to claim 8 wherein:

the semiconductor wafer has an assigned tracking code;

and before applying at least two different operative refining motions, the method having the additional steps of:

providing an operative control subsystem having an operative sensor, a controller, and a processor; ~~processor and wherein the processor has access to a process model, the assigned tracking code, and information in at least one memory device;~~

and during applying at least two different operative refining motions, the method having the additional steps of:

sensing a progress of refining information with the operative sensor;

determining a change for at least one control parameter using at least in part at least ~~the~~ a process model, the assigned tracking code, the information in at least one memory device, and the progress of refining information with the operative control subsystem; and

changing in real time the at least one process control parameter which changes the refining.

19. (Origingal) A method for refining a semiconductor wafer having a semiconductor wafer surface comprising the steps of:

providing at least two refining elements;

holding the semiconductor wafer for refining; and

applying at least two different, independent operative refining motions to the at least two refining elements and wherein the operative refining motions include at least one electrochemical action during at least a portion of a refining cycle time.

20. (Currently amended) The method for refining according to claim 19 wherein:

the semiconductor wafer has an assigned tracking code;

and before applying at least two different, independent operative refining motions, the method having the additional steps of:

providing an operative control subsystem having an operative sensor, a controller, and a processor; ~~processor and wherein the processor has access to a process model, the assigned tracking code, and information in at least one memory device;~~

and during applying at least two different, independent operative refining motions, the method having the additional steps of:

sensing a progress of refining information with the operative sensor;

determining a change for at least one control parameter using at least in part at least ~~the~~ a process model, the assigned tracking code, ~~the~~ information in at least one memory device, and the progress of refining information with the operative control subsystem; and

changing in real time the at least one process control parameter which changes the refining.

21. (Origingal) The method according to claim 20 wherein the semiconductor wafer has a low k layer having a k value of at most 3.5.

22. (Currently amended) A method of removing an unwanted material from a semiconductor wafer having a tracking code and a semiconductor wafer surface comprising:

a step (A) providing a refining element having a refining surface and having a first operative electrode;

a step (B) positioning the semiconductor wafer surface with a holder having an operative electrical contact forming a second operative electrode proximate to the refining element;

a step (C) applying an operative refining motion comprising a parallel operative refining motion in the interface between the semiconductor wafer surface being refined and the refining surface of the refining element; and

a step (D) applying refining energy ~~an operative voltage~~ across the first operative electrode and the second operative electrode for electro-refining to remove the unwanted material on the semiconductor wafer surface during at least a portion of a refining cycle time;

a step (E) sensing progress information of the refining of the semiconductor wafer surface with an operative control subsystem having access to a process model and a historical performance;

a step (F) determining at least one improved control parameter using at least in part at least the process model, the tracking code, the historical performance, and the progress information with the operative control subsystem; and

a step (G) controlling in real time the at least one process control parameter to change the refining.

23. (Original) The method of claim 22 wherein:

in step (A) the refining element has an identification code;

in step (F) the operative control system has access to the identification code and the determining at least one improved process control parameter comprises using at least in part at least the process model, the tracking code, the historical performance, the refining element identification code, and the progress information with the operative control subsystem;

24. (Currently amended) A method for refining comprising:

a step (A) applying a refining energy to a workpiece with a refining element;

a step (B) providing an operative control subsystem having an operative sensor, a controller, and a processor; ~~processor and wherein the processor has access to:~~

~~(i) a process model,~~

~~(ii) an assigned workpiece tracking code, and~~

~~(iii) information in at least one memory device;~~

a step (C) sensing progress of refining information with the operative sensor during a period of non-steady refining;

a step (D) determining a change for at least one improved control parameter using at least in part at least

(i) ~~the~~ a process model,

(ii) ~~the~~ an assigned workpiece tracking code,

(iii) ~~the~~ information in at least one memory device, and

(iv) progress of refining information with the operative control subsystem during the period of non-steady refining; and

a step (E) changing in real time the at least one process control parameter which changes the refining during the period of non-steady refining.

25. (Origingal) The method according to claim 24 wherein the step (C), the step (D), and the step (E) are repeated at least 4 times during a single period of non-steady state refining.

26. (Origingal) The method according to claim 24 wherein:
the refining element has a refining element tracking code; and
in step (D) determining a change comprises determining a change for at least one improved control parameter using at least in part at least
(i) the process model,
(ii) the assigned workpiece tracking code,
(iii) the information in at least one memory device,
(iv) the refining element tracking code; and
(v) progress of refining information with the operative control subsystem during the period of non-steady refining.

27. (Origingal) A method of refining of a first semiconductor wafer, a second semiconductor wafer, and a third semiconductor wafer and wherein:
the first semiconductor wafer has tracking code "D",
the second semiconductor wafer has a tracking code "E", and
the third semiconductor wafer has a tracking code "F",
the method of refining comprising:
a step (1) providing a refining element having a tracking code "RE";
a step (2) providing an operative control subsystem having a processor and at least one operative sensor for sensing real time progress information;
a step (3) applying a refining energy to the surface of a first semiconductor wafer having at least one control parameter;
a step (4) sensing progress information "G" with the at least one operative sensor in real time;
a step (5) determining in real time at least one improved control parameter "A" using
(i) the tracking code "D",
(ii) the tracking code "RE", and

(iii) the progress information "G" for the first semiconductor wafer with the operative control subsystem;

a step (6) controlling in real time the at least one process control parameter "A" to change the refining for the first semiconductor wafer;

a step (7) storing for future availability stored information related to:

(i) the at least one control parameter "A",

(ii) progress information "G",

(iii) the tracking code "RE", and

(iv) the tracking code "D";

a step (8) applying the refining energy to the surface of a second semiconductor wafer having at least one control parameter "B";

a step (9) sensing progress information "H" with the at least one operative sensor in real time;

a step (10) determining in real time at least one improved control parameter "B" for the second semiconductor wafer surface using at least a portion of the stored information related to:

(i) the at least one control parameter "A",

(ii) the progress information "G",

(iii) the progress information "H",

(iv) the tracking code "RE",

(v) the tracking code "D", and

(vi) the tracking code "E" for the second semiconductor wafer with the operative control subsystem;

a step (11) controlling in real time the at least one process control parameter "B" for the second semiconductor wafer surface to change the removal of material from the refining for the second semiconductor wafer;

a step (12) storing for future availability stored information related to:

(i) the at least one control parameter "A",

(ii) the at least one control parameter "B",

(iii) the progress information "G",

(iv) the progress information "H",

(v) the tracking code "RE",

(vi) the tracking code "D", and

(vii) the tracking code "E";

a step (13) applying the refining energy to the surface of a third semiconductor wafer having at least one control parameter "C";

a step (14) sensing progress information "I" with the at least one operative sensor in real time;

a step (15) determining in real time at least one improved control parameter "C" for the third semiconductor wafer surface using at least a portion of the stored information related to:

(i) the at least one control parameter "A",

(ii) the at least one control parameter "B",

(iii) the at least one control parameter "C",

(iv) the tracking code "D",

(v) the tracking code "E",

(vi) the tracking code "F",

(vii) the tracking code "RE",

(viii) the real time progress information "G",

(ix) the real time progress information "H", and

(x) the progress information "I" for the third semiconductor wafer with the operative control subsystem; and

a step (16) controlling in real time the at least one process control parameter "C" for the third semiconductor wafer surface to change the refining for the third semiconductor wafer.

28. (Origingal) The method according to claim 27 wherein in each of the steps (3), (8), and (13) of applying the refining energy comprises applying at least two independent refining energies.

29. (Origingal) The method according to claim 27 wherein in each of the steps (3), (8), and (13) of applying the refining energy comprises applying at least two different refining energies.

30. (Origingal) The method according to claim 27 wherein in each of the steps (3), (8), and (13) of applying the refining energy comprises applying at least two different, independent refining energies.

31. (Origingal) The method according to claim 27 wherein in each of the steps (3), (8), and (13) of applying the refining energy comprises applying at least one electrochemical energy for removing material from the semiconductor wafer surface.

32. (Origingal) The method according to claim 27 wherein in each of the steps (3), (8), and (13) of applying the refining energy comprises applying at least one electrochemical energy for adding material to the semiconductor wafer surface.

33. (Origingal) A method of refining of a first and a second layer on a semiconductor wafer, each having an effect on the cost of manufacture, the method comprising:

a step (1) applying a first refining energy to the first layer of the semiconductor wafer;

a step (2) sensing a real time process information for the first layer of the semiconductor wafer with at least one operative sensor;

a step (3) determining in real time at least one improved first layer control parameter "A" using a first tracking code and a real time progress information for the semiconductor wafer with an operative control subsystem having the at least one operative sensor;

a step (4) controlling in real time the at least one first layer process control parameter "A" to change the semiconductor wafer surface during the refining of the first layer of the semiconductor wafer;

a step (5) storing for future availability stored information related to the at least one first layer process control parameter "A", the first tracking code, and the real time progress information for the first layer refining;

a step (6) applying a second refining energy to the second layer of the semiconductor wafer having at least one second layer control parameter "B";

a step (7) sensing a real time process information for the second layer of the semiconductor wafer with the at least one operative sensor;

a step (8) determining in real time at least one improved second layer control parameter "B" using at least a portion of the stored information related to the tracking code, the first layer progress information, and the second layer progress information of the semiconductor wafer with the operative control subsystem; and

a step (9) controlling in real time the at least one second layer process control parameter "B" to change the semiconductor wafer surface during the refining of the second layer of the semiconductor wafer.

34. (Origingal) The method according to claim 33 wherein the step (4) controlling in real time the at least one first layer process control parameter "A" comprises controlling in real time the at least one first layer process control parameter "A" to change the removal of material from the semiconductor wafer surface during the refining of the first layer of the semiconductor wafer.

35. (Origingal) The method according to claim 33 wherein the step (1) of applying the first refining energy comprises applying at least two independent refining energies.

36. (Origingal) The method according to claim 33 wherein the step (1) of applying the first refining energy comprises applying at least two different refining energies.

37. (Origingal) The method according to claim 33 wherein the step (1) of applying the first refining energy comprises applying at least two different, independent refining energies.

38. (Origingal) The method according to claim 33 wherein the step (1) of applying the first refining energy comprises applying at least one electrochemical energy for removing material from the semiconductor wafer surface.

39. (Origingal) The method according to claim 33 wherein the step (1) of applying the first refining energy comprises applying at least one electrochemical energy for adding material to the semiconductor wafer surface.

39. (Origingal) The method according to claim 33 wherein the step (9) of controlling in real time comprises controlling in real time the at least one second layer process control parameter "B" to change the removal of material from the semiconductor wafer surface during the refining of the second layer of the semiconductor wafer.

40. (Origingal) The method according to claim 33 wherein the step (6) of applying the second refining energy comprises applying at least two independent refining energies.

41. (Origingal) The method according to claim 33 wherein the step (6) of applying the second refining energy comprises applying at least two different refining energies.

42. (Origingal) The method according to claim 33 wherein the step (6) of applying the second refining energy comprises applying at least two different, independent refining energies.

43. (Origingal) The method according to claim 33 wherein the step (6) of applying the second refining energy comprises applying at least one electrochemical energy for removing material from the semiconductor wafer surface.

44. (Origingal) The method according to claim 33 wherein the step (6) of applying the second refining energy comprises applying at least one electrochemical energy for adding material to the semiconductor wafer surface.

45. (Origingal) The method according to claim 33 wherein:

the step (4) controlling in real time the at least one first layer process control parameter "A" comprises controlling in real time the at least one first layer process control parameter "A" to change the removal of material from the semiconductor wafer surface during the refining of the first layer of the semiconductor wafer; and

the step (9) of controlling in real time comprises controlling in real time the at least one second layer process control parameter "B" to change the removal of material from the semiconductor wafer surface during the refining of the second layer of the semiconductor wafer.

46. (Origingal) The method according to claim 33 wherein:

the step (1) of applying the first refining energy comprises applying at least two independent refining energies; and

the step (6) of applying the second refining energy comprises applying at least two independent refining energies.

47. (Origingal) The method according to claim 33 wherein:

the step (1) of applying the first refining energy comprises applying at least two different refining energies; and

the step (6) of applying the second refining energy comprises applying at least two different refining energies.

48. (Origingal) The method according to claim 33 wherein:

the step (1) of applying the first refining energy comprises applying at least two different, independent refining energies; and

the step (6) of applying the second refining energy comprises applying at least two different, independent refining energies.

49. (Origingal) The method according to claim 33 wherein:

the step (1) of applying the first refining energy comprises applying at least one electrochemical energy for removing material from the semiconductor wafer surface; and

the step (6) of applying the second refining energy comprises applying at least one electrochemical energy for removing material from the semiconductor wafer surface.

50. (Origingal) The method according to claim 33 wherein:

the step (1) of applying the first refining energy comprises applying at least one electrochemical energy for adding material to the semiconductor wafer surface; and

the step (6) of applying the second refining energy comprises applying at least one electrochemical energy for adding material to the semiconductor wafer surface.

51. (Origingal) A magnetic refining element comprising:

at least one magnetically responsive refining member having at least one electrode;

at least one refining surface; and

wherein the magnetic refining element has an identification code.

52. (Origingal) The magnetic refining element of claim 51 wherein the at least one magnetically responsive refining member has at least two electrodes.

53. (Origingal) The magnetic refining element of claim 51 wherein the at least one magnetically responsive refining member has at least two different refining surfaces.

54. (Origingal) The magnetic refining element of claim 51 wherein the refining surface comprises at least in part a finishing surface free of abrasive particles.

55. (Origingal) An apparatus for refining a workpiece surface comprising:

at least one magnetically responsive refining element free of any nonmagnetic driving mechanism;

at least one magnetic driving element; and

a holder for a workpiece which exposes the workpiece surface for refining.

56. (Origingal) The apparatus according to claim 55 wherein the at least one magnetically responsive refining element has a refining element tracking code.

57. (Origingal) The apparatus according to claim 55 further comprising an operative control subsystem having an operative sensor, a controller, and a processor.

58. (Origingal) The apparatus according to claim 57 wherein:

the at least one magnetically responsive refining element has a refining element tracking code; and

the processor has access to the refining element tracking code.

59. (Origingal) The apparatus according to claim 57 wherein:

the at least one magnetically responsive refining element has a refining element tracking code;

the processor has access to the refining element tracking code; and

wherein the processor has access to a processor readable media having processing instructions which use the refining element tracking code to determine improved control during a refining cycle time.

60. (Origingal) The apparatus according to claim 57 wherein:

the at least one magnetically responsive refining element comprises at least two magnetically responsive refining elements and the at least two magnetically responsive refining elements have at least two different refining element tracking codes;

processor has access to the at least two different refining element tracking codes; and

wherein the processor has access to a processor readable media having processing instructions which use the refining element tracking code to determine a change for at least one control parameter during a refining cycle time.

61. (Origingal) An apparatus for refining comprising:

at least one magnetically responsive refining element having a tracking code;

a refining element placement arm having a electromagnet for lifting, placing, and releasing the magnetically responsive refining element; and

an operative sensor to sense the tracking code; and an operative controller to control the refining element placement arm for lifting, placing, and releasing the magnetically responsive refining element.

62. The apparatus according to claim 61 wherein:

the at one least one magnetically responsive refining element comprises at least two magnetically responsive refining elements;

and the apparatus further comprising at least two magnetic driving elements.

63. (Origingal) The apparatus according to claim 61 wherein:

the at least one magnetically responsive refining element comprises at least two magnetically responsive refining elements and the at least two magnetically responsive refining elements have at least two different refining element tracking codes;

and the apparatus further comprises:

at least two magnetic driving elements;

an operative control subsystem having an operative sensor, a controller, and a processor and wherein the processor has access to the at least two different refining element tracking codes; and

wherein the processor has access to a processor readable media having processing instructions which use the at least two different refining element tracking codes to determine a change for at least one control parameter during a refining cycle time.

64. (Origingal) The apparatus according to claim 63 wherein the processing instructions include controlling the at least two magnetically responsive refining elements with different refining motions during the refining cycle time.

65. (Origingal) The apparatus according to claim 63 wherein the processing instructions include controlling the at least two magnetically responsive refining elements with independent refining motions during at least the refining cycle time.

66. (Origingal) The apparatus according to claim 63 wherein the processing instructions include controlling the at least two magnetically responsive refining elements with different, independent refining motions during at least the refining cycle time.

67. (Currently amended) An apparatus for refining a workpiece surface comprising:

at least two refining elements having at least two different identification codes;

at least two driving mechanisms for at least two refining motions for the at least two refining elements during at least a portion of the refining cycle time;

a holder for a workpiece which exposes the workpiece surface for refining; and

an operative control subsystem having an operative sensor, a controller, and a processor and wherein the processor has access to the at least two different refining element identification codes and wherein the processor has access to a processor readable media having processing instructions which use at least in part the at least two different refining element identification codes to determine a change for at least one control parameter during a refining cycle time.

68. (Origingal) The apparatus according to claim 67 wherein the at least two refining motions comprise at least two different refining motions during the refining cycle time.

69. (Origingal) The apparatus according to claim 68 wherein the at least two refining elements include at least one electrode.

70. (Origingal) The apparatus according to claim 67 wherein the at least two refining motions comprise at least two independent refining motions during the refining cycle time.

71. (Origingal) The apparatus according to claim 70 wherein the at least two refining elements include at least one electrode.

72. (Origingal) The apparatus according to claim 67 wherein the at least two refining motions comprise at least two different, independent refining motions during the refining cycle time.

73. (Origingal) The apparatus according to claim 72 wherein the at least two refining elements include at least one electrode.

74. (Currently amended) At least three apparatus according to claim 67 wherein:

each the at least three apparatus have at least two different refining element identification codes forming a family of at least six refining element identification codes, each being different from each other;

each of the at least three apparatus have access to a processor and wherein the processor has access to the family of at least six refining element identification codes; and wherein the processing instructions comprise the processing instructions which use the family of at least six refining element identification codes to determine a change for at least one control parameter during a refining cycle time.

75. The apparatus according to claim 74 wherein the at least two refining elements include at least one electrode.